Determinant Factors of Environmental Responsibility for the Passenger Car Users

Arokiaraj David, Kattepogu Nagarjuna, Moiz Mohammed, Jegadesan Sundar

Abstract: ***The main aim of this study is to find out the demographic variables and their driving factors influencing the environmental responsibility of passenger car users. There are around 73.85 million passenger car was produced (OICA, 2018), and it is forecasted that 2 billion of car expected on the road before the end of 2040. Vehicles are the primary generator of emission per liter of fuel exhausts around 140-210 Co_2/km released in the air. The people who are using the vehicles are to be held responsible for the vulnerability which is resulted because of emission from the tailpipe. According to the Japan Automobile Manufacturer Association (JAMA), 80% of tailpipe emission was released by the vehicle users and the remaining 20% by the vehicle manufacturers. Therefore this paper understands the factors influencing the environmental responsibility of the passenger car users.***

Keywords: Environmental Responsibility, Passenger Car Users, Eco-friendly practice.

I. INTRODUCTION

The Auto industry plays a significant role in global environmental degradation. This sector alone is anticipated to grow a more considerable amount of emission (40%) by 2030 due to the rapid production of vehicles (Sagar, 1995). The World Resource Institute (WRI) reported that 15% of man-made greenhouse gas was emitted by vehicle users in the form of tailpipe emission. It contains Carbon monoxide (CO), Carbon dioxide (Co_2), unburned HC, NO_x, So_x, lead and PM (OICA, 2015). Carbons and Particulate Matter (PM) are highly toxic which was released during the vehicle usage phase through the tailpipe.

Day-by-day the pollution density is also increasing rapidly due to the massive production of vehicles. It is estimated that around 2 billion of the car was expected on the road before the end of 2040. As per the current vehicle emission norms, per liter of fuel exhausts around 140-210 Co_2/km released in the air. It directly helps to form the greenhouse gas emission, global warming, climatic change, ozone layer depletion, reducing air quality.

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It is also known that one of the primary sources of air pollution is the automobile itself. According to the Japan Automobile Manufacturer Association (JAMA), 80% of pollution was released by vehicle users and the remaining 20% of pollution contributed by vehicle manufacturers (JAMA, 2016).

The users of the vehicles are to hold the main responsibility for the tragedy in the form of vehicle tailpipe emission (Aurora's, P. G., 2018, Arokiaraj, 2018). According to the environmental study 2007, the overall Indian per capita of carbon emissions were approximately 3,000 pounds (Srivel et. al., 2018).

The report of the World Health Organization (WHO) marked that the Indian Metropolitan cities are measured, the result shows that's the smuttiest air in the world. The study conducted by the Centre of Science and Environmental (CSE) that the world's top 20 polluted cities among that 13 cities are situated in India. According to Teri Environmental Survey 2014, the vehicle emission is contributed to more than 40-65% of air pollution in the city of Delhi, Mumbai, Kolkata, Bangalore, Chennai, Hyderabad, Guwahati, Kanpur, Jamshedpur, Indore, Coimbatore, Faridabad, Varanasi, Gaya and Patna whereas, in a local newspaper has reported that the vehicle users created 70% of pollution (Arokiaraj David, 2019b).

In a developing country like India, around 900 million people are exposed to an unhealthy level of pollution due to the emissions caused by motor vehicles (Faiz, 1993). As per the World Health Organisation (WHO), the major cities in South East Asia are holding the worst statistics in terms of air pollution in the context of the whole world. Around 5 lakhs of people are killed every year in major cities of South East Asia which hold air pollution at the worst condition at the global level as per the reports of the World Health Organization (WHO) (R.N. Wahal, 2006). It is estimated that due to dirty air 13 million die every year, out of which one-third in the developing countries. Air pollution is considered the deadliest form, and it's becoming the 4th risk factor for premature deaths worldwide (Ramachandra, 2015) whereas in India it kills 6.2 lakhs of people in an annum and 2 Indians for every one minute are losing their lives (WHO, 2014). Apart from these emissions, it, directly and indirectly, affects the human's health by becoming a reason for the damage of both internal and also external organs by resulting in various diseases (Arokiaraj David, 2019c). It includes ischemic heart disease (48%), stroke (25%), obstructive pulmonary disease (17%), lower respiratory infections (6%), and trachea, bronchus and lung cancer (2%) and others.

II. LITERATURE REVIEW

The literature was studied about the environmental responsibility of the car users on the environmental perspective with the help of their environmental driving approaches. The environmental driving behavior is the action of an individual that promotes practices, drives, and acts towards eco-friendly manner. The seriousness of the environmental issues, consumers are concerned about environmental degradation and to protect the environment (Kim & Damhorst, 1998; Eswaraiah et. al., 2019). It has become an important issue in today's' society. The vehicle users are well aware of the environmental problems and know their role in protecting the environment (Arokiaraj David, 2019a; Pratheepkumar, 2017). There is a tremendous improvement can be witnessed in the making of engine technology and car performance in the last two decades. However, the drivers driving style and their attitude towards these do not change as per the requirements of the environmental obligation. With environmental driving, more than 2 million tonnes of CO (Carbon Dioxide) can be reduced.

Environmental driving means, a systematic way of driving a vehicle which can reduce the consumption of the fuel, avoid accident rate, energy-efficient, control greenhouse gas and another emission, (Arokiaraj, 2018; Aurora, PG., 2018). It not only protects the environment as well as fuel consumption. This driving style can be applied to any vehicle which enhances more economically as well as ecologically. Van Mierloet al., 2014, experimented with the heavy-duty vehicle users about their driving style related to speed and emission. The result shows that speed and emission are interrelated with each other which means high speed emits more emission and average will be more economical. It was proved that the driving speed determines the fuel consumption. Kanok Oriboonsomsin et al. 2010, analyze the changes among the US drivers about eco-friendly driving will increase up to 40% of the fuel and environmental protection (Srivel Ravi, 2018). Further, there is no environmental standard that has to explain how to drive an environment-friendly manner and it found that existing environmental norms set standards for per kilometer tailpipe emission. Therefore, it will not solve the problem of vehicular pollution in the future. It can be controlled on the vehicle user's demographical, anthropological, geographical, sociological and psychological aspects.

2.2 Research Gap

This study was conducted based on the existing literature related to the factor's determinants for environmental responsibility to vehicle users. Further, there is no study found the relationship between the demographic profile of passenger car users and environmental responsibility, and further extended the relationship between environmental friendly activities to environmental responsibility.

III. OBJECTIVE OF THE STUDY

The key objective of this study is to find out the demographics influencing factors on environmental responsibility. Also, to understand the environmentally friendly activities which improve the environmental responsibility of passenger car users. To test these objectives, the below hypothesis was framed.

IV. HYPOTHESIS OF THE STUDY

The hypothesis was framed based on the objective of the study,

H_{01} = There is no significant relationship between gender and environmental responsibility of passenger car users

H_{02} = There is no significant relationship between marital status and environmental responsibility of passenger car users

H_{03} = There is no significant relationship between Educational Qualification and environmental responsibility of passenger car users

H_{04} = There is no significant relationship between Income level and environmental responsibility of passenger car users

H_{05} = There is no significant relationship between Age and environmental responsibility of passenger car users

H_{06} = There is no significant relationship between driving experience and environmental responsibility of passenger car users

H_{07} = There is no significant relationship between Driving Style and environmental responsibility of passenger car users

H_{08} = There is no significant relationship between City Speed and environmental responsibility of passenger car users

H_{09} = There is no significant relationship between Highways Speed and environmental responsibility of passenger car users

H_{010} = There is no significant relationship between Saving Environment and environmental responsibility of passenger car users

H_{011} = There is no significant relationship between Environment Knowledge and environmental responsibility of passenger car users

H_{012} = There is no significant relationship between Speed Limit and environmental responsibility of passenger car users

H_{013} = There is no significant relationship between Trip Plan and environmental responsibility of passenger car users

H_{014} = There is no Significant relationship between Tightening Cap and environmental responsibility of passenger car users

H_{015} = There is no Significant relationship between Tire Pressure and environmental responsibility of passenger car users

H_{016} = There is no Significant relationship between Engine Gently and environmental responsibility of passenger car users

V. RESEARCH METHODOLOGY

To test this hypothesis, the statistical tools were selected are independent sample T-test, one-way ANOVA and Pearson correlation. Based on the review of the literature the objectives, hypothesis, and the questionnaire was framed based on the passenger car users. The primary data was collected with the help of a questionnaire. A Five-point Likert scale was applied (Strongly Agree, to Strongly Disagree) in the questionnaire for the environmental responsibility of the passenger car users and demographic variables are also included as mentioned in the below chart.

The data have been gathered from the 400 passenger car users through a simple random sampling method from the Chennai region. The collected data was analyzed with the help of descriptive statistics, T-test, ANOVA and Correlation were performed in the Statistical Package of Social Science (SPSS) version 20. To analyze the collected information null hypothesis was framed above and test below. The reliability was tested with Cronbach's Alpha value (α.850) with seven variables as mentioned in the independent variables. The normality of data was also tested with the help of Skewness and Kurtosis value; the result shows that all values are less than ±1.96 as mentioned in the below table 1.

5.1 Demographic Profile of the Passenger Car Users

The profile of the respondents was categories into two types, are passenger car users profile and car profile. The passenger car users were categorized into gender, age, educational qualification, monthly income, and marital status. The car profile was categorized into drivers driving experience, driving style, speed in the city, and speed in highways.

5.1.1 PASSENGER CAR USER'S PROFILE

Chart 1: Gender

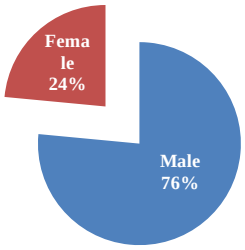


Chart 2: Marital Status

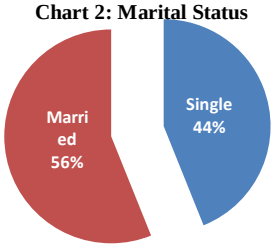


Chart 3: Educational Qualification

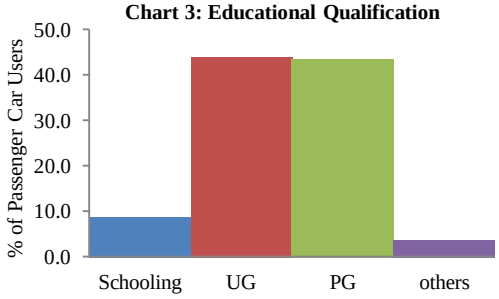


Chart 4: Income Per Month

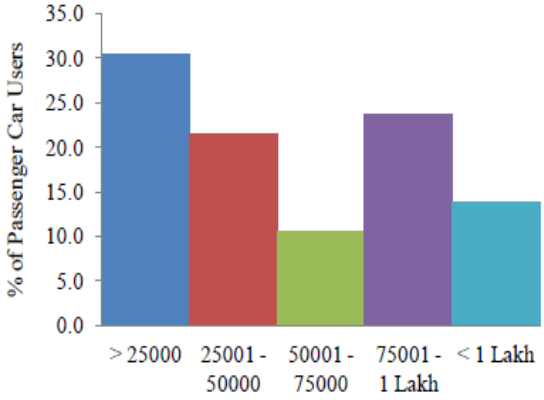
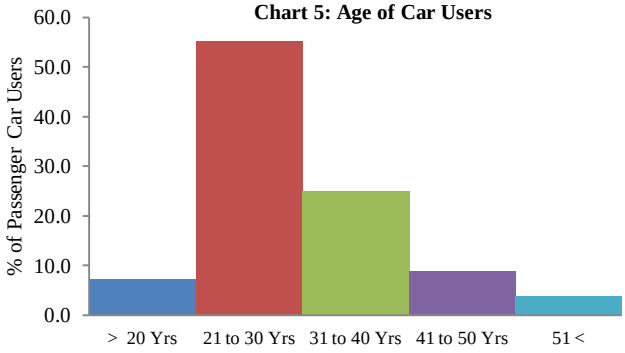


Chart 5: Age of Car Users



5.1.2 CAR PROFILE

Chart 6: Driving Experience

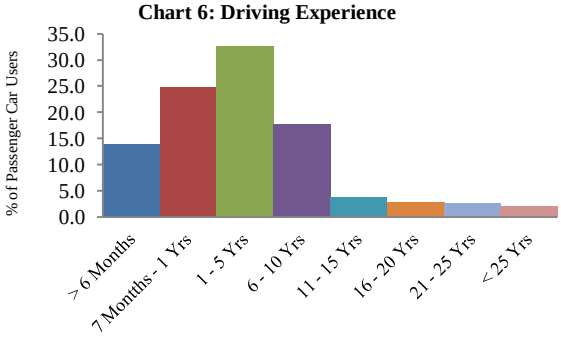


Chart 7: Driving Style

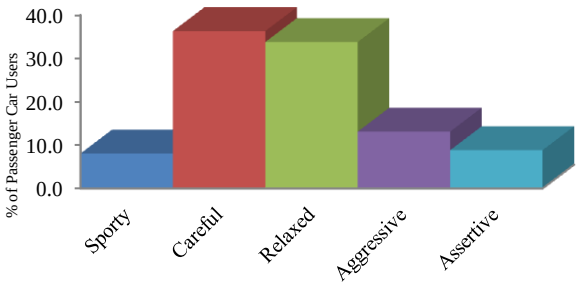


Chart 8: Speed in Highways

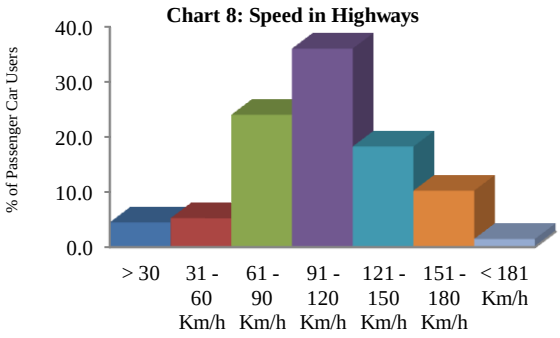
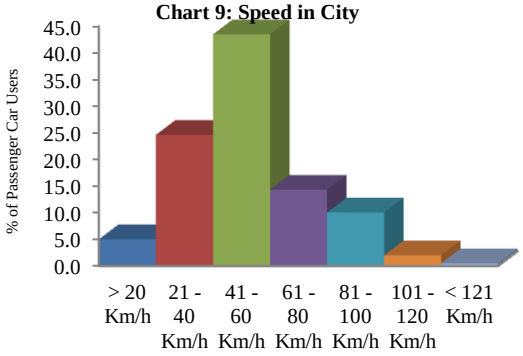


Chart 9: Speed in City



From the collected data, the demographic profile for passenger car users is visualized above chart 1 to 9, out of that 76% are male and female 24%, 56% are married, and 44% are not married. Among that, 87% had completed their degree and earned less than 25,000 per month (31%). Around 55% of passenger car users are aged between 21 to 30 years old. The car profile of passenger car users had experience of 1-5 years (33%), and 36% of car users are carefully driving their vehicle with a speed of 41-60 km/h in the city and in highways in-between 91-120 km/h.

Table 1: Descriptive Statistics of Environmental Responsibility of the Passenger Car Users

Descriptive Statistics	Mean	Standard Deviation	Skewness Value	Kurtosis Value
Environmental Responsibility	4.02	0.882	-1.048	0.419
Accelerate the engine gently	4.05	1.041	-1.042	0.350
Always schedule the plan before starting the trip	4.34	0.859	-1.431	1.126
Tightening the fuel tank cap regularly	4.22	0.896	-0.914	-0.095
Frequently checking the tire pressure	4.15	0.995	-1.235	1.090
It is essential to drive below the posted speed limit	3.96	1.216	-1.141	0.340
Sharing environment knowledge to others	4.01	1.046	-0.861	-0.177
Saving the environment aspect while using the car	4.14	0.905	-0.902	0.506

The descriptive statistic of passenger car user's as shown in the above table. The data was collected by using a five-point Likert scale stated that strongly agree to disagree strongly. The coding of the scale was given based on this weight (5=Strongly Agree, 4=Agree, 3=Neutral, 2=Disagree, and 1=Strongly Disagree), based on this core value recognize that higher the mean value means practicing environmental driving and higher the environmental responsibility. In the above table stated that always schedule the plan before starting the trip (mean value = 4.34), tightening the fuel tank cap regularly (mean value = 4.22), frequently checking the tire pressure (mean value = 4.15), saving the environment aspect while using the car (mean value = 4.14) and accelerate the engine gently (mean value = 4.05).

Table 2: Independent Sample T-Test and One-Way ANOVA for the Environmental Responsibility of Passenger Car Users

Independent Samples T-Test	Hypothesis	F-Value	P-Value	Test Result
Gender	H_{01}	0.144	0.536	Not Significant
Marital Status	H_{02}	7.071	0.001***	Supported
One-Way ANOVA	**Hypothesis**	**F-Value**	**P-Value**	**Test Result**
Educational Qualification	H_{03}	5.830	0.001***	Supported
Income	H_{04}	1.694	0.151	Not Significant
Age	H_{05}	7.422	0.000***	Supported
Driving Experience	H_{06}	1.376	0.214	Not Significant
Driving Style	H_{07}	15.304	0.000***	Supported
Highways Speed	H_{08}	6.786	0.000***	Supported
City Speed	H_{09}	9.902	0.000***	Supported

Note: *** = Statistically significant at the 0.01 level.
Note: * =Statistically significant at the 0.050 level.

The Independent samples T-test and ANOVA test were performed to test the significant level of demographic and car users profile to environmental responsibility of passenger car users. Based on the above table it is found, in T-test, the marital status (P-value = 0.001) is statistically significant with the environmental responsibility; whereas in One-Way ANOVA found that the educational qualification (degree holders), age (more than 51 years), driving style (careful drives), city (41 - 60 Km/h) and highways speed (91- 120 Km/h) these group are statistically significant with the environmental responsibility of the passenger car users. These groups are concerned about the environment, in other words, the high level of responsibility towards the environment.

Table 3: Pearson Correlation Test for the Environmental Responsibility of Passenger Car Users

Hypothesis	Pearson Correlation for Environmental Responsibility			Test Result
H_{010}	Saving environment	Pearson Correlation	.819***	Supported
		P-Value	0.000	
H_{011}	Sharing environment knowledge	Pearson Correlation	.881***	Supported
		P-Value	0.000	
H_{012}	Speed limit	Pearson Correlation	.871***	Supported
		P-Value	0.000	
H_{013}	Trip plan	Pearson Correlation	.312***	Supported
		P-Value	0.000	
H_{014}	Tightening fuel cap	Pearson Correlation	.485***	Supported
		P-Value	0.000	
H_{015}	Checking tire pressure	Pearson Correlation	.502***	Supported
		P-Value	0.000	
H_{016}	Accelerate engine gently	Pearson Correlation	.561***	Supported
		P-Value	0.000	

Note: *** = Correlation is significant at the 0.01 level (2-tailed).

Hypothesis 10 to 16 is framed to test the practice of environmental driving towards the environmental responsibility of passenger car users. The Pearson correlation was performed between the dependent variable (environmental
responsibility), and the independent variable is saving the environment, sharing environment knowledge, speed limit, trip plan, tightening cap, tire pressure, and accelerate engine gently. It is found that all the independent variables are statistically significant with the environmental responsibility at a 1% level with a P-value of 0.000. Further it has a positive relationship with the environmental responsibility of passenger car users which means that saving the environment (81%), sharing environment knowledge (88%), speed limit (87%), trip plan (31%), tightening fuel cap (48%), checking tire pressure (50%), and accelerate engine gently (56%) will have an impact on the environmental responsibility of passenger car users.

VI. CONCLUSION

It is concluded that passenger car users having their environmentally concerned in terms of accelerating the engine gently, always checking their tire pressure, schedule to plan the trip and sharing environmental problems to others will increase their environmental responsibility. Based on the result of the T-test and ANOVA found that the degree holders and senior citizens are careful drives their vehicle with a speed limit of 41-60 Km/h in the city and 91-120 Km/h in highways having more responsible towards the environment as well as saving their fuel economically and environmentally.

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6.2 ABBREVIATION

a) The World Resource Institute (WRI)
b) The Organisation Internationale des Constructeurs d'Automobiles (OICA)
c) The Japan Automobile Manufacturer Association (JAMA)
d) The Centre of Science and Environmental (CSE)
e) The World Health Organization (WHO)